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(54) Title: FIXING DEVICE FOR FIXING VERTEBRA PARTS

(57) Abstract: Fixing device for fixing two vertebra parts with respect too one another, and the method for fixing two vertebra parts. The fixing device comprises fixing plates which have to be secured to the relevant vertebra parts. The fixing plates are provided with countersunk openings for receiving the heads of fixing screws. Sleeves which project out of the fixing plates and are to be held in the vertebra adjoin these fixing openings. The fixing plates are fixed with respect to one another with the aid of a connecting system comprising two lips, which lie at a distance from one another, in one fixing plate and a tongue, which can be placed between the said lips, belonging to the other fixing plate. A clamping action of the tongue between the lips can be brought about by a spreading action.

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### Fixing device for fixing vertebra parts

The present invention relates to a fixing device for fixing two bone parts with respect to one another, which device comprises two fixing plates, which are each provided with  
5 openings for receiving securing means, such as screws for securing the said fixing plate to the said bone part, as well as connecting means for fixing the said fixing parts with respect to one another, said connecting means comprising a first connecting part, which is connected to the first fixing plate, and a second connecting part, which is connected to the second fixing plate, said first and second connecting parts being slideable along  
10 and fixable with respect to one another.

A fixing device of this type is known from FR 2766353A. This device is used in particular, although not exclusively, for fixing vertebra parts. For all kinds of reasons, it is necessary for vertebrae to be fixed with respect to one another, so that they can grow  
15 together. For this purpose, the prior art uses a fixing device comprising fixing plates which are to be secured to each of the vertebra parts.

The fixing plates can move with respect to one another. The fixing plates bear against one another, the lower fixing plate being provided with a screw thread and the upper  
20 fixing plate being provided with an opening for receiving a screw. This opening is of elongate design, so that the fixing plates can be adjusted with respect to one another.

It has been found that, under some circumstances, it is difficult to ensure optimum fixing with a design of this type, since, during surgery, a screwdriver has to be used to  
25 exert a considerable force on the screws, and this is not possible under all circumstances. Moreover, in many applications it is desirable to exert a compression on the bone parts in which anchoring is taking place. The bone parts can be made to grow together rapidly as a result of these bone parts being pressed against one another (if appropriate with a further bone part between them). This is not possible with the design  
30 shown in FR 2766353.

Moreover, in particular immediately after fitting, there is a risk of the screws becoming loose, with all the associated consequences. Therefore, patients are kept in hospital for

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a long time and their movement is limited as far as possible, in order to avoid such problems.

5 The object of the present invention is to provide a more stable structure in which there is less interference with the surrounding tissue. Moreover, a structure of this type must be spatially stable. The rigidity is of particular importance in this context.

10 In a fixing device as described above, this object is achieved in that the first connecting part comprises two spaced lips for receiving the tongue-like second connecting part in between.

15 These connecting parts interact with one another as a result of being designed in such a manner that they can slide along one another. This sliding may be a telescopic movement or any other form of sliding movement. In this way, it is possible to obtain a compact structure which projects to a much lesser extent with respect to the bone parts than structures according to the prior art. Firstly, there is less irritation to the surrounding tissue, and secondly the moment which is applied during compression of the bone parts when the fixing plates are being fitted is considerably limited, and in fact simply comprises tension in reaction to the compression.

20 According to an advantageous embodiment, the connecting parts are designed as a tongue, which is connected to one fixing plate, and two lips, which lie at a distance from one another and are arranged in the second fixing plate, with the tongue sliding between the lips. The tongue can be clamped between the lips as a result of a spreading mechanism.

25 Spreading can be achieved, for example, as a result of conical screws being introduced into openings in the tongue. When they are tightened further, these conical screws press the tongue against the lips so that it is clamped in place. Moreover, the tongue/lips can be roughened in order to improve engagement.

30 Further stability can be obtained if, in the direction of movement of the connecting parts, the screws lying opposite one another belonging to the different connecting parts

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are arranged with their ends converging in the bone part in question.

According to an advantageous embodiment, said fixing plates comprise a sleeve-like part which extends beyond them and has a bore with a first diameter which lies in line  
5 with an opening in said plate which has a second, larger diameter.

As a result of the openings being designed in a particular way, with the sleeve-like part adjoining them, it is firstly possible to allow screws to be countersunk in the fixing plates. This means that there are no longer any projecting screws, with the result that  
10 the surrounding tissue is not irritated. Particularly stable positioning results from the presence of the sleeves which engage in particular in the hard outer layer of the bone of the vertebra part. The screws extend into the softer core part of the bone. The external diameter of sleeves of this type will generally be greater than the diameter of screws which are customary in the prior art, and since they can be of externally smooth design,  
15 optimum engagement with the harder part of the bone is ensured.

According to an advantageous embodiment of the invention, sleeves of this type are designed to taper conically on the outside in the direction of the bone. This makes it possible to attain improved fixing in the bone.

20 It is possible to provide for locking between the screw and the opening in any way which is known from the prior art. For example, it is possible to fit projections/recesses. A design of this type is particularly simple to implement if the sleeve-like part is provided with a screw thread which is used to guide the corresponding screw. After all,  
25 when the screw is being screwed in, the force exerted on the screw through engagement with the core material of the bone will be relatively low, and consequently it is not under all circumstances possible to easily feel when the relevant screw is "tight". Providing the sleeve-like part with a screw thread, optionally in combination with an indicator in the vicinity of the opening for the corresponding screw, corresponding to  
30 an indicator on the screw itself, allows accurate control of the tightening of the screw in the softer part of the bone.

The invention also relates to a kit comprising a fixing device according to the

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invention, and screws for securing it, which screws comprise a head with a diameter which is slightly smaller than the said second diameter of the said opening for receiving them.

5 More particularly, the screws described above are provided with two different screw threads. A first screw thread with a relatively large minor diameter, which is designed to engage on the sleeve-like part, which may optionally be provided with a screw thread. The second screw thread is used to cut into the softer bone material. In this case, the minor diameter is preferably smaller.

10

The invention will be explained in more detail below with reference to an exemplary embodiment which is illustrated in the drawing, in which:

15 Fig. 1 shows a perspective, diagrammatic view of the two fixing plates of the fixing device according to the invention in an exploded state;

Fig. 2 shows the way in which bores are made in a vertebra part which is to be provided with the fixing plates according to the invention;

Fig. 3 shows a fixing plate according to the invention arranged on a vertebra part; and

20 Fig. 4 shows a fixing plate according to the invention arranged on two vertebra parts which lie at a distance from one another; and

Fig. 5 diagrammatically depicts the fixing device according to the invention arranged on two vertebra parts in accordance with the invention.

25 The fixing device according to the invention is illustrated as an example in the drawings and is denoted overall by 1. It comprises two fixing plates 2, 3 which can be fixed with respect to one another. Each fixing plate comprises a body part 4. Fixing plate 3 is provided with a tongue 5 which projects from the body part as connecting means which is provided with small bores 8 which are adjoined by slots 20. As an alternative to the arrangement shown in the drawing, the end of the tongue may be  
30 rounded.

Fixing plate 2 is provided with two lips 6 which lie opposite one another and between which a groove 7 is delimited. The lips are connected beneath the groove by means of a



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base 21.

The spacing between the lips 6, i.e. the width of the groove 7, is such that tongue 5 can be received in sliding fashion in the groove. If appropriate, tongue 5 and groove 7 are designed in dovetail form, so that these parts can be guided in a very precise manner with respect to one another. Tongue 5 is fixed in groove 7 as a result of a screw 22 being fitted into bore 8 (Fig. 4), with the result that the slots 20 are spread open, thus producing a clamping action.

Each of the body parts 4 is provided with two openings. Details of these openings can be seen from Fig. 3. Each opening is denoted by 9 and has a relatively large diameter for receiving the head 13 of a screw 12. Sleeves 10 are present adjacent to each opening 9 and projecting with respect to each fixing plate. These sleeves are designed to taper conically on the outside in the direction away from the plate, i.e. to taper conically towards their free end, and have a smaller bore, so that the head 13 of the screw 12 comes to lie on the top part of the sleeve 10. If appropriate, the sleeves 10 may be provided with a screw thread 16. The centre line of the sleeves is denoted by 17, and as can be seen from Fig. 3, an angle  $\alpha$  is delimited between these two centre lines. This angle  $\alpha$  is dependent on the application, and in the case of vertebrae, for example, is preferably between 11 and 14°.

Fig. 2 shows the way in which bores are made in a vertebra part 18. They are stepped bores. Bores of this type can be produced in one or two steps using an optionally stepped drill.

25

After these bores have been made, it is possible to introduce screws 12. These screws 12 are provided with two types of screw thread. A first screw-thread part 14 corresponds to the screw thread 16 in the sleeve part 10 and has a relatively small pitch. A second screw-thread part 15 has a larger pitch and is used for optimum engagement with the relatively soft core material of the vertebra part in question.

30

The fixing device described above is secured in the following way to the vertebra parts 18 and 19 which are shown in Fig. 4. First of all, the fixing plates 2 and 3 are slid into

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one another, or are supplied in such a state. Then, they are positioned with respect to one another, in such a way that the corresponding fixing plates can be arranged in the corresponding bores in the vertebrae 18 and the vertebra part 19, respectively. The sleeves 10 provide optimum engagement between the top, widened part of the bores in the vertebra parts, as a result of the conically tapering free ends. Then, the screws 12 are introduced until the relevant fixing plates have been completely fixed. Then, the screws are locked. This can take place in any conceivable way which is known from the prior art. One possibility is for the screws 12 to be provided with a notch, while the edge of the openings 9 is provided with a projection, with the result that a type of snap-in effect is obtained. Another possibility is for the screws 12 to become jammed in a screw thread which is arranged in a corresponding way in the sleeves. Fig. 4 shows a diagrammatic, partial cross section illustrating that the free ends of screws belonging to opposite fixing plates point towards one another. This allows a relatively high compression force to be absorbed.

15

External compression of this type is applied after the fixing plates 2 and 3 have been secured, as illustrated in Fig. 5.

When sufficient force is applied, screw 22 is introduced, with the result that tongue 5 is clamped against lips 6. Then, the external compression can be removed and the result is an externally smooth assembly, in which the force is transmitted to the wall of the opposite vertebra part at the minimum possible distance from the wall of the corresponding vertebra parts. Particularly stable anchoring of the fixing plate is achieved by the design in accordance with the invention. It will be understood that the construction according to the invention makes it considerably easier to fix the fixing plates with respect to one another. Unlike in the prior art, it is no longer necessary to laboriously fit fixing pins at an operation site which is difficult to reach.

25

It will also be understood that the screws may comprise any structure which is known in the prior art. It is possible to use screws with a double screw thread. The screws are accurately guided by the bore 11 in sleeve 10.

30

Simple means can be used to apply the compression forces by traction between the two

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closest parts of the two fixing plates. This contrasts with the arrangement which is known in the prior art, in which pressure is exerted on the parts of the structure which lie furthest apart.

- 5 On reading the above description, the person skilled in the art will actually arrive at variants which are obvious and lie within the scope of the appended claims. Moreover, the invention can be used not only to fix vertebra parts, but also to fix other bone parts.



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Claims

1. Fixing device (1) for fixing two bone parts (18, 19) with respect to one another, which device comprises two fixing plates (2, 3), which are each provided with openings  
5 (9) for receiving securing means, such as screws (12) for securing the said fixing plate to the said bone part, as well as connecting means for fixing the said fixing parts with respect to one another, said connecting means comprising a first connecting part, which is connected to the first fixing plate, and a second connecting part, which is connected to the second fixing plate, said first and second connecting parts being slideable and  
10 fixable with respect to one another, characterized in that the first connecting part comprises two spaced lips (6) for receiving the tongue-like second connecting part in between (5).
2. Fixing device according to Claim 1, in which said second connecting part is  
15 spreadable in order to be clamped between the said lips.
3. Fixing device according to one of the preceding claims, in which said fixing plates comprise a sleeve-like part (10) which extends beyond them and has a bore (11) with a first diameter which lies in line with an opening (9) in the said plate which has a  
20 second, larger diameter.
4. Fixing device according to Claim 3, in which the said sleeve-like part is provided with a screw thread (16).
- 25 5. Fixing device according to Claim 3 or 4, in which the centre axes of sleeve-like parts of two fixing plates are designed to extend towards one another in the direction of the free ends of the screws.
6. Fixing device according to one of Claims 3-5, in which the sleeve-like part tapers  
30 conically on the outside towards its free end.
7. Fixing device according to one of the preceding claims, in which at least two openings which are provided with a sleeve-like part are arranged on a fixing plate,

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which openings are not aligned with respect to the centre line which connects the said two fixing plates in the fitted state, the centre lines of the said bores being arranged at an angle with respect to one another in the plane which is perpendicular to the centre line which connects the said two fixing plates in the fitted state.

5

8. Kit comprising a fixing device according to one of the preceding claims, and screws (12) for securing it, which screws comprise a head with a diameter which is slightly smaller than the said second diameter of the said opening for receiving them.

10

9. Kit according to Claim 8, in which the said screws are provided with a first screw thread (14) in the vicinity of the head, with a relatively large core diameter and a second screw thread (15) in the vicinity of their free end, with a relatively small diameter.

15

10. Method for fitting a fixing device for fixing two bone parts with respect to one another, comprising the provision of openings in the related bone parts, positioning a fixing plate onto said openings, using screws to secure the fixing plates and fix the fixing plates with respect to one another, wherein providing said openings comprises preparing at least two bores, which are at an angle in the direction perpendicular to the connecting line between the fixing plates, for each fixing plate, characterized in that said bores, parallel to the connecting line between the fixing plates, are at an angle which is such that the free ends of the screws which are to be introduced point towards one another.

20

11. Method according to Claim 10, in which the angle of the bores, in the direction perpendicular to the connecting line between the fixing plates, is between 11 and 14°.

25

12. Method according to one of Claims 10 or 11, in which said fixing plates are initially fixed to the vertebra parts in such a manner that they can move with respect to one another only in the direction of the connecting line between said fixing plates, and then the fixing plates are secured to the relevant bones.

30

13. Method according to Claim 12, in which, after the said fixing plates have been

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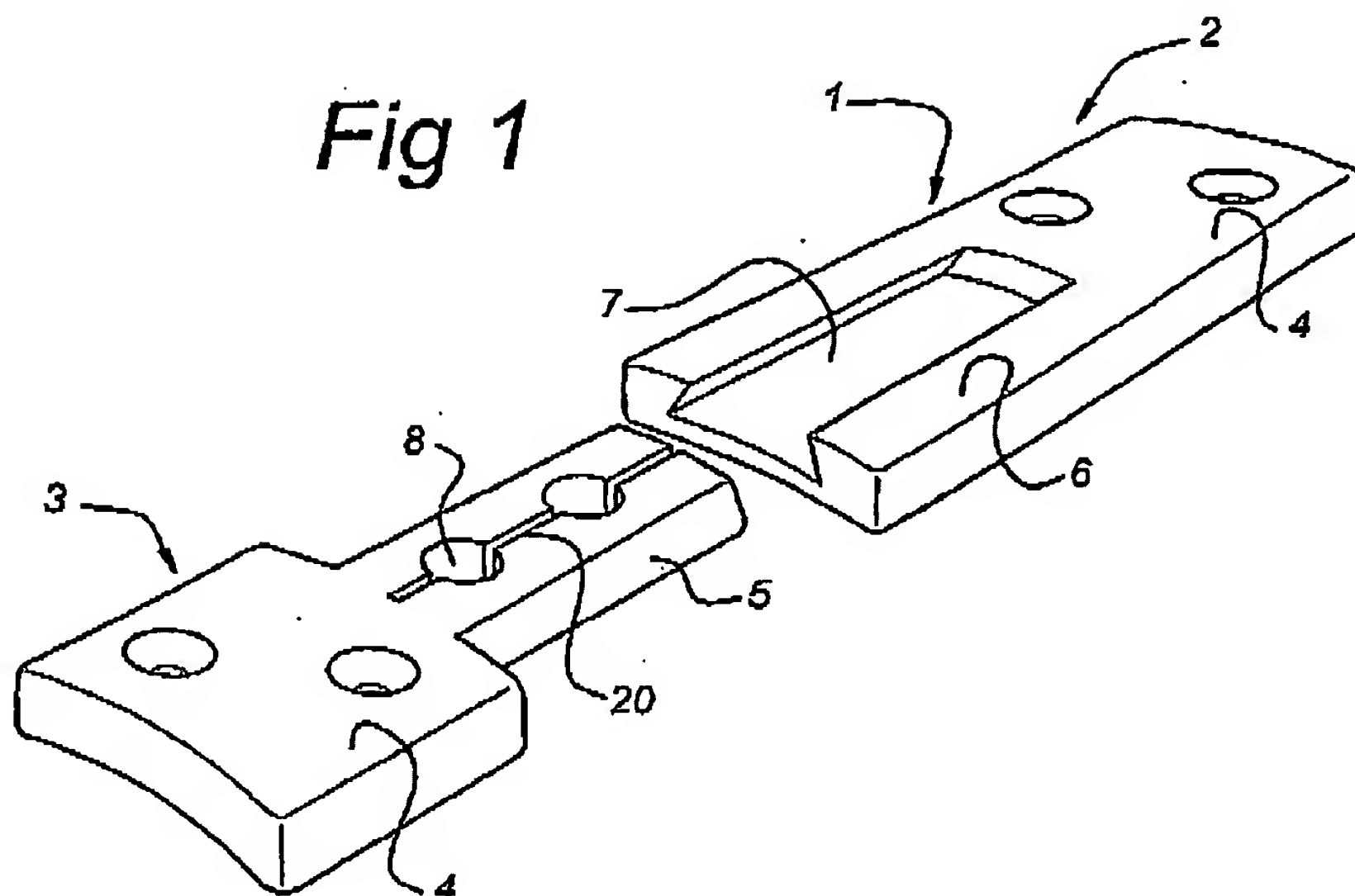
secured to the bones, said fixing plates are driven towards one another and are fixed with respect to one another.

14. Method according to Claims 10-13, in which the said screws (12) are locked.

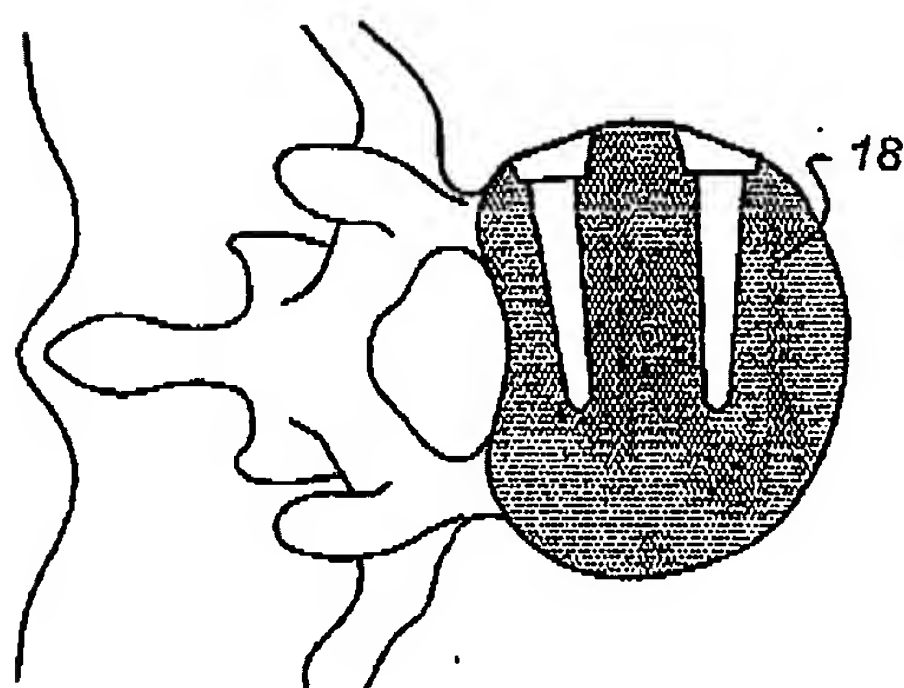
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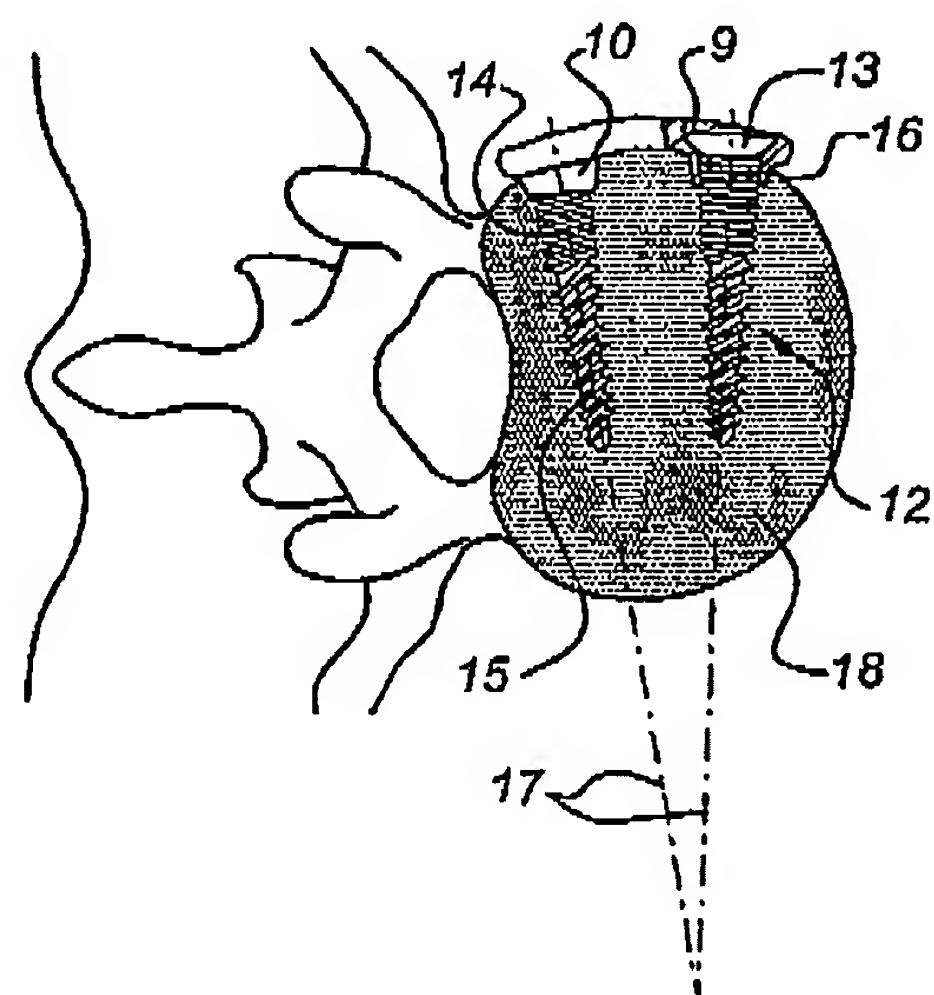
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**Fig 2**



**Fig 3**



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*Fig 4*

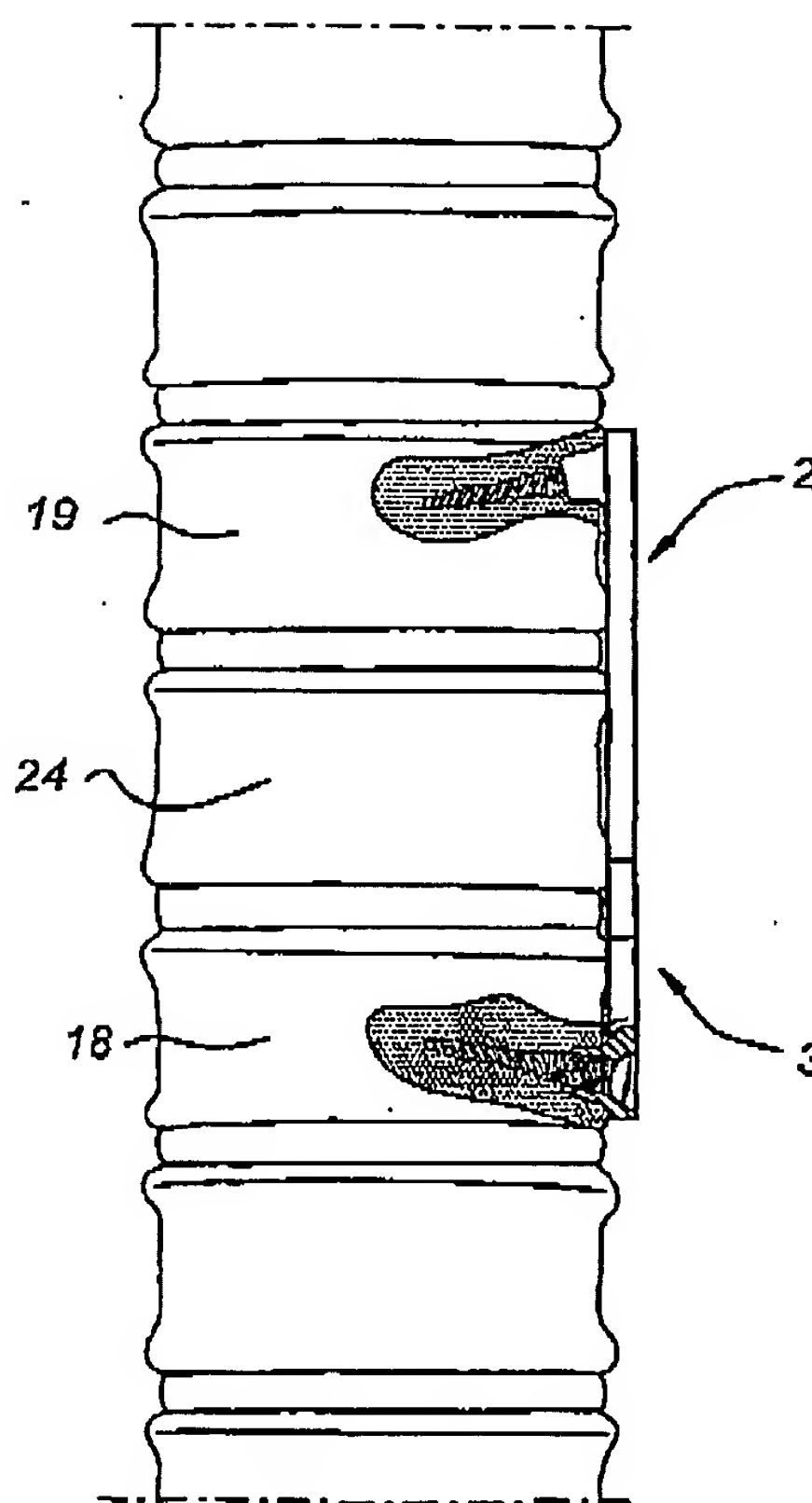
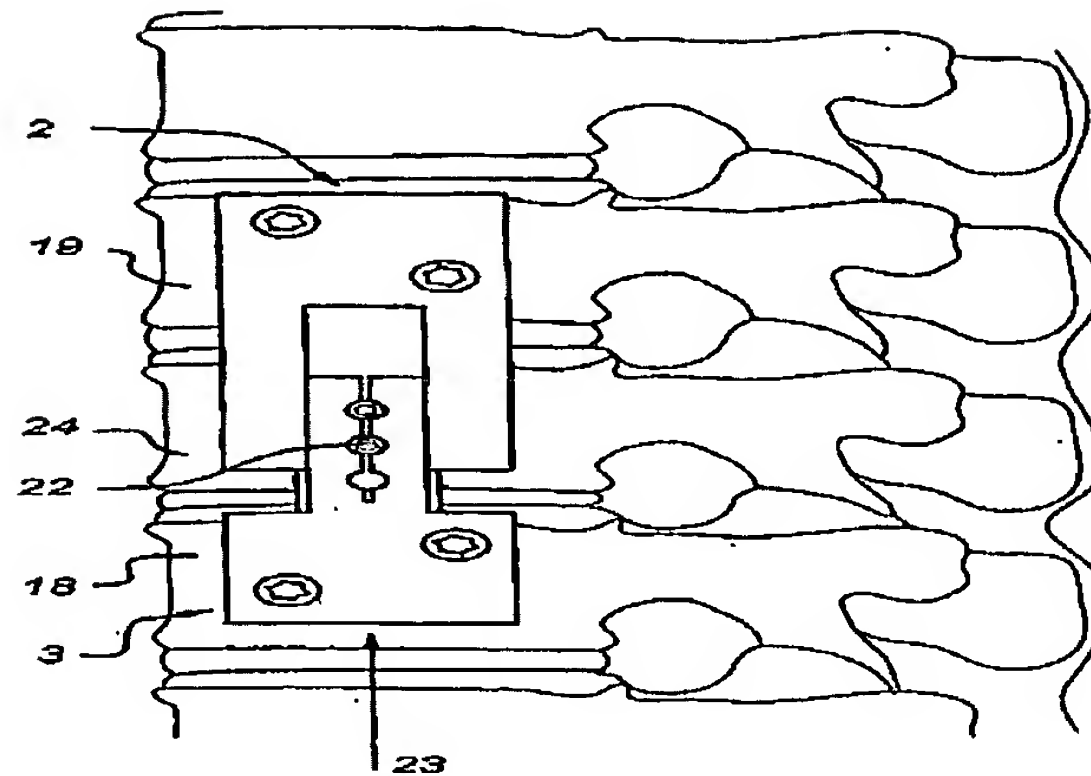




Fig 5



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(74) Agent: JORRITSMA, Ruurd et al; Nederlandsch Octrooibureau, Scheveningsweg 82, P.O. Box 29720, NL-2502 LS The Hague (NL).

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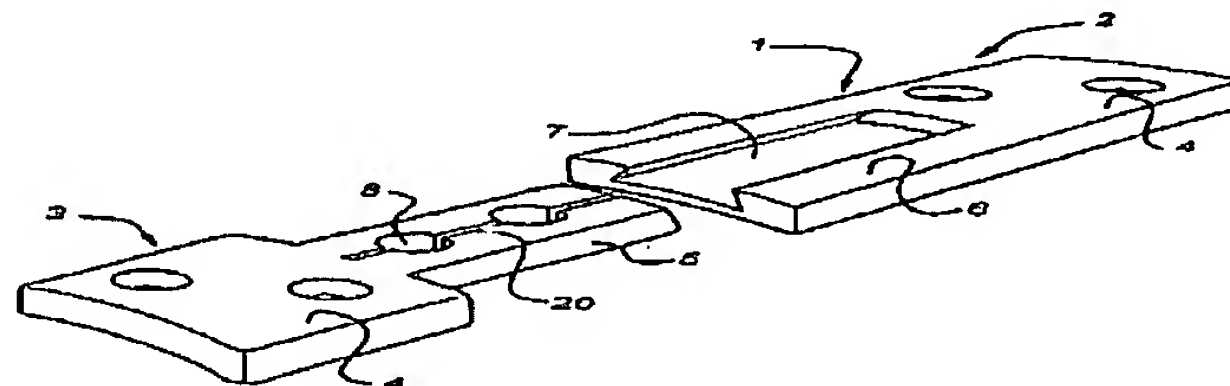
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

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(54) Title: FIXING DEVICE FOR FIXING VERTEBRA PARTS



(57) Abstract: Fixing device for fixing two vertebra parts with respect to one another, and the method for fixing two vertebra parts. The fixing device comprises fixing plates which have to be secured to the relevant vertebra parts. The fixing plates are provided with countersunk openings for receiving the heads of fixing screws. Sleeves which project out of the fixing plates and are to be held in the vertebra adjoin these fixing openings. The fixing plates are fixed with respect to one another with the aid of a connecting system comprising two lips, which lie at a distance from one another, in one fixing plate and a tongue, which can be placed between the said lips, belonging to the other fixing plate. A clamping action of the tongue between the lips can be brought about by a spreading action.

## INTERNATIONAL SEARCH REPORT

Inter national Application No  
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A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 A61817/70 A61817/80

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 A618

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 616 142 A (H.A.YUAN AND C.-I.LIN) 1 April 1997 (1997-04-01)	1
Y	figures 1,3B,4A-4B column 1, line 65 - line 67 column 2, line 57 - line 62	3-9
Y	DE 93 03 830 U (AAP) 9 June 1993 (1993-06-09) page 1, line 4-6 page 2, line 1-4 figures	3-9
A	FR 2 766 353 A (DIMSO) 29 January 1999 (1999-01-29) abstract; figures page 6, line 24 - line 34 page 8, line 23 -page 9, line 22	1,3-5, 7-9
	-/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance  
 "E" earlier document but published on or after the international filing date  
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Date of the actual completion of the international search

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29/08/2002

Name and mailing address of the ISA

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## INTERNATIONAL SEARCH REPORT

Internal Application No.  
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C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99 38447 A (DEPUY INTERNATIONAL) 5 August 1999 (1999-08-05). figures 4,5	6
A	US 5 147 361 A (S.OJIMA AND H.MATSUZAKI) 15 September 1992 (1992-09-15) column 2, line 56 -column 3, line 10; figures 1A-1D, 2A	4,7-9
E	US 6 402 756 B1 (J.D.RALPH AND S.TATAR) 11 June 2002 (2002-06-11) abstract; figure 4 column 8, line 25 - line 55	1,2

Form PCT/ISA210 (continuation of second sheet) (July 1992)

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## INTERNATIONAL SEARCH REPORT

 International application No.  
PCT/NL 02/00270

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 10-14  
because they relate to subject matter not required to be searched by this Authority, namely:  
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1988)

## INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. Appl. No.

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